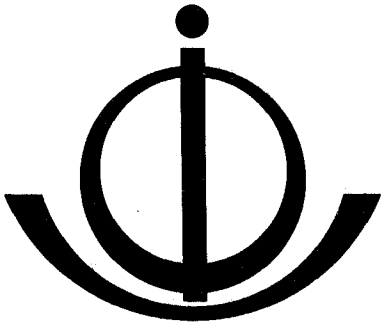

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCEANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISION OCEANOGRAFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلم المحيطات

TSUNAMI NEWSLETTER

INTERNATIONAL TSUNAMI INFORMATION CENTER
P.O. Box 3830, Honolulu, Hawaii 96812.

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INTERNATIONAL TSUNAMI INFORMATION CENTER

Director: George Pararas-Carayannis
Associate Director: Norman M. Ridgway

TSUNAMI NEWSLETTER is published by the International Tsunami Information Center to bring news and information to scientists, engineers, educators, community protection agencies and governments throughout the world.

We welcome contributions from our readers.

The International Tsunami Information Center is maintained by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization. The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.

MEMBER STATES

Present membership of the International Coordination Group for the Tsunami Warning System in the Pacific comprises of the following States:

CANADA
CHILE
CHINA, MAINLAND
ECUADOR
FIJI
FRANCE
GUATEMALA
INDONESIA
JAPAN
KOREA
NEW ZEALAND
PERU
PHILIPPINES
SINGAPORE
THAILAND
UNITED KINGDOM (HONG KONG)
USA
USSR
WESTERN SAMOA

(For those readers unfamiliar with the Pacific Tsunami Warning Center [PTWC], we have included the following article briefly describing their operation.)

The Pacific Tsunami Warning Center (PTWC)

The Pacific Tsunami Warning Center (PTWC), is a fourteen building complex located near the center of a 175 acre tract between Fort Weaver Road and North Road at the East edge of Ewa Beach, Hawaii. It is a Pacific Region National Weather Service field facility with programs covering a number of responsibilities relating to geophysics.

PTWC is responsible for evaluating seismic and water level data from the entire Pacific and issuing appropriate watches and warnings to U.S. interests in the Pacific. It also distributes tsunami watches and warnings to warn International participants throughout the Pacific basin.

PTWC serves as the Regional Tsunami Warning Center for the Hawaiian Islands providing rapid reaction to earthquakes occurring in the Hawaiian region.

In addition to the Tsunami Warning Services, PTWC has a Seismic Data Program; a complete Geomagnetic Program; and, cooperatively records geophysical data for six other Agencies and Universities. PTWC also develops techniques to improve the warning system by applying research methods to the warning operations.

The importance of particular items varies from day to day. There may be times when all types of routine work may have to be temporarily suspended in order that urgent tsunami watch or warning can be distributed rapidly to the public in and near the threatened areas.

A staff of five specialists work an irregular work week with standby duty to give twenty-four hour coverage for the Tsunami Warning Center and to produce accurate continuously recorded geophysical data.

Tsunami Warning Program

The Tsunami Warning Program provides the capability to issue appropriate tsunami watch and/or warnings to all recipients in the dissemination network.

Instructions for conducting the Tsunami Warning Service are expanded in the 'Communications Plan for Tsunami Warning System.' This plan is distributed to all participants to assure standardized operational procedure.

Portions of the seismic systems are specifically dedicated to the Tsunami Warning Program. These dedicated seismic systems provide continuous visible recording of -

a. Long Period (LP) (20 sec/cycle) seismic data at magnifications of 10, 100 and 1,000 in each of the Vertical, North-South, and East-West modes.

b. Short Period (SP) (1 sec/cycles) seismic data at a magnification of 6,000 in the Vertical mode at PTWC and from eight remote points telemetered to the main console.

Pacific Tsunami Warning Center, Ewa Beach, Hawaii

c. Short Period, three component system operating at a magnification of 1000 and a Short Period, Vertical at a magnification of 10 used for strong local earthquake data analysis.

The Tsunami Warning Program requires a twenty-four hour watch using a minimum of two personnel constantly monitoring earthquake activity. This is accomplished by using a standby schedule with five of the seven staff members living in homes on PTWC grounds. The phone system and a seismic event alarm extends to the five homes.

During non-work hours, weekends and holidays two staff-members are always on standby duty at their residence. A third person carries a "call mate" when leaving the area and is subject to recall at any hour if a tsunami watch or warning is to be issued.

The Pacific Tsunami Warning System, operationally controlled by the Pacific Tsunami Warning Center, makes use of 21 seismic stations, 51 tide stations and 55 dissemination points scattered throughout the Pacific basin under the varying control of seventeen different nations with general guidance from the Intergovernmental Oceanographic Commission (IOC) of the United Nations. This vast array of cooperating units is connected with a an elaborate communications system.

Detailed logs are kept for all potentially tsunamigenic activity.

Seismic Data Program

In addition to the tsunami dedicated systems described above, four additional LP systems and one additional SP system are in operation, recording at magnifications ranging from 750 to 50,000.

Geomagnetic Data Program

Four photographically recorded magnetograms are produced daily showing variations in the earths magnetic field as to vertical intensity, horizontal intensity and declination. Two recording speeds are used for each component to facilitate variation analysis. Absolute control readings are applied weekly using a Proton Vector Magnetometer.

Dissemination

The major dissemination responsibility is the tsunami watch and/or warning. The dissemination program is a sophisticated cooperative venture using existing facilities of the Defense Communication Agency (DCA), Federal Aviation Administration (FAA), National Aeronautical and Space Agency (NASA), U.S. Army, U.S. Navy, U.S. Air Force, U.S. Coast Guard, various foreign agencies and private companies. Flash precedence is authorized thus interrupting any channel as required to disseminate a tsunami warning.

The communications systems to the 55 dissemination points along with most data gathering stations are tested monthly. The tests are authorized by and monitored for minimum message travel times by the National Communications System (NCS), Washington, D.C.

These 55 dissemination points in turn disseminate to many more points in their respective local areas.

Communications

The sophisticated communication system uses a teletype in the Departments of Defenses Automatic Digital Network (AUTODIN), another in the Federal Aviation Administration International Teletype Net, the DOD's Automatic Voice Network (AUTOVON), DOD's Hawaii Warning System (HAWAS), Hawaii Civil Defenses' Radio Net and Hawaiian Telephone Company's commercial phone system to provide rapid and reliable communications to all areas of the Pacific.

Each staff member is trained in the operation of all the systems. Interconnecting alternate routings provide coverage in the event of individual system failures. Maintenance is provided at top priority by the individual agencies involved.

Automation

Since 1974, PTWC has worked to automate many of the operational tasks required during earthquake/tsunami investigations. A mini-computer system has been shown to be the most effective way to implement automation. Up until 1978, PTWC utilized a time share computer system for

automated message generation and earthquake epicenter location and magnitude determination. In June 1978, PTWC acquired its own mini-computer system to expand automation capabilities. The tasks to be assigned to the new system include

a. Real time monitoring and processing of seismic data.

b. Monitoring the communications systems for exchange of seismic and tide data, and issuance of tsunami watch and warnings.

c. Local and teleseismic earthquake magnitude determination.

d. As a tool for developing techniques to improve the tsunami warning services provided by PTWC.

Data Bases Containing Natural Hazards Literature

In the Abstracts & Resumes section of this Newsletter we refer to a publication "Information Sources for Natural Hazards Research," by Kathleen Torres and Penny Waterstone. The following article is based upon that publication.

Computer searches of literature have several advantages including increased efficiency and speed. The search can be modified to suit individual needs through the selection or exclusion of key words, the specification of certain time periods or authors, etc. Also many computerized information retrieval systems will aid the user in devising the most effective approach for retrieval of the desired information.

The quality of the search will depend on the amount of relevant data available in the base and the degree of agreement between the data base coding of the topic and the search request wording of the topic.

However, computerized indexes are usually more helpful in providing a basic bibliography on a subject rather than additional citations to an extensive bibliography. Also, since many computer indexes are constructed from manual indexes, there is often a delay of a year or more between the publication date of an item and its computer index listing.

Prices for a natural hazard search from a single data base range from approximately $12.00 to $50.00 according to the complexity of the search, the number of citations and whether or not abstracts are required. Request for searches may be made directly through the mail from the addresses given in the following section but may be cheaper if placed through a computer based reference service often available at large academic libraries and businesses.

Compendex

Contains roughly 2300 engineering publications including professional and industrial journals, as well as those of research institutes, professional societies, and governmental agencies.

Prepared by: Engineering Index, Inc.
345 East 47th St.
New York, NY 10017

GeoRef

About 1200 serials on geological literature available. Prepared by the American Geological Institute from the Bibliography and Index of Geology.

GeoRef (Bibliography and Index of Geology)
American Geological Institute
5205 Leesburg Pike
Falls Church, VA 22041

NTIS

Government-sponsored research based on Government Reports Index and Government Reports Abstracts from over 240 agencies comprise the National Technical Information Service, Dept. of Commerce's data base. More than one thousand published computer searches available and original on-line searches possible for special research needs. Advertised price is $100.00 for 100 citations with abstracts; $25.00 for pre-published searches.

Available from: U.S. Dept. of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OASIS

The National Oceanic and Atmospheric Administration controls the Oceanic and Atmospheric Scientific Information System, which includes literature and research concerning environmental sciences and marine coastal resources. Various indexes available are listed in: User's Guide to OASIS, Oceanic and Atmospheric Scientific Information System. Key to Oceanic and Atmospheric Sources #1. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service. GPO. 1974. Two data bases in OASIS helpful to natural hazards research are MGA, constructed Meteorological and Geophysical Abstract, and SWRA, constructed from SWRA - Selected Water Resources Abstracts.

Available from: Technical Information Division
National Oceanic and Atmospheric Administration
Washington, DC 20235

Participating Tidal Stations Operated by the U.S. National Weather Service

Scattered throughout the Central and Western Tropical Pacific, the U.S. National Weather Service maintains and operates a number of Weather Service Offices. Located on small, and generally remote, atolls and islands, these stations provide invaluable weather data from these sparsely-occupied

regions of the Pacific. In addition to their meteorological duties, many of these stations operate tide gauges and are participating tide stations within the Pacific Tsunami Warning System.

Presently, Weather Service Offices at Hilo and Lihue, Hawaii; Johnston and Wake Islands; Pago Pago, Truk, Yap, and Koror operate tide gauges and are participating tide stations in the Pacific Tsunami Warning System. Tide gauges are also operated by Weather Service personnel at San Diego and Sacramento, California. It is through the continuing dedication and support by weather office personnel and of tide gauge operators and observers in these locations and in Member States that the Pacific Tsunami Warning System is able to function effectively.

NEWS EVENTS

Korean Scientist Makes Working Visit to ITIC

Mr. Myong Bok An, Director of Weather Analysis, Central Meteorological Office, Seoul, Republic of Korea, recently completed a 6-week assignment to ITIC. His visit was made under the Intergovernmental Oceanographic Commission's visiting scientist program.

In his report on the visit, Mr. An pointed out that although Korea has been relatively immune to tsunami damage in the past, its nearest neighbours, China and Japan, have been attacked frequently by earthquakes and tsunamis. For this reason, the possibility of a tsunami striking the Korean peninsula cannot be overlooked. So, upon his return to Korea, Mr. An will try to disseminate the knowledge he gained on tsunamis not only to his colleagues, but also to the Korean Government and people. He will emphasize the following aspects:

1. The relationship between earthquakes and tsunamis.

2. The physical characteristics of tsunamis.

3. The tsunami watch and warning system.

4. The procedures adopted in the event of a tsunami disaster in the U.S.

We are confident that Mr. An's visit to ITIC will result in increased cooperation between Korea and other Member States of the Pacific Tsunami Warning System.

US/USSR Tsunami Experiment

Two Soviet scientists -- Dr. V. Pavlenko (Director, Sakhalin Hydrometeorological Research Institute) and Dr. A. Ivoschenko (Sakhalin Scientific Research Institute) were recent visitors to ITIC. They were in Honolulu to plan the second US/USSR Open Ocean Tsunami Experiment which is to be carried out in August-October 1978. Dr. Robert Harvey of the Joint

(ICG/ITSU) in May 1978. This action followed the establishment in Indonesia of a National Tsunami Working Group in October 1977 and its participation as an observer at the 6th Meeting of ICG/ITSU held in Manila, Philippines in February 1978. This now brings the total number of Member States to seventeen.

Long Wave Symposium - Ottawa, Canada

An International Symposium on Long Waves in the Ocean was held in Ottawa, June 6-8, 1978. Consecutive sessions covered tidal observation, analysis, and theory, tsunamis, storm surges, and continental shelf waves. The 40 papers presented both theoretical and applied material, and several showed the close interrelationship of the subjects. Some of the papers dealing with trapping and deflection of long waves may have special significance in interpreting the propagation of tsunamis.

The tsunami session was chaired by Sydney Wigen and included the following papers:

Murty, T.S. Some interesting problems in tsunami research.

Adams, W.M. (presented by H. Loomis)
Tectonic explanation of some observed tsunamicity patterns.

Loomis, H.G. Relationship of seismic parameters to tsunami generation.

Sklarz, M.A. and L.O. Spielvogel
Transient tsunami response by the finite element method.

Mass, W.J., R.O. Reid and A.C. Vastano
Derivation of quasi-long wave equations employing variational principles.

Two additional papers were given on the final day of the proceedings:

Nakamura, S. (read by T.S. Murty)
On statistical tsunami risk of Indonesia.

Nelson, J. World Data Center A - tsunami data files holdings and objectives.

Four-page summaries of the papers will be published in the Manuscript Report Series of the Marine Sciences Directorate. Copies will be mailed to all participants. This publication may also be requested from the Marine Science Directorate, 240 Sparks Street, Ottawa, Canada, K1A 0E6.

UNESCO - IOC - ITSU

FAO-IOC Issue International Directory of Marine Scientists

Eleven thousand scientists from 63 countries are included in the second edition of the International Directory of Marine Scientists which has

recently been issued by the FAO in collaboration with the Intergovernmental Oceanographic Commission.

This edition is a revision of the first directory published by FAO in 1970. Updating of the computerized register from which the directory is derived began immediately after the first edition was printed. In March 1976 letters were sent from SCOR to its national committees and from the IOC to national contacts, requesting the submission of current lists of marine scientists in each country.

This information was added to the ASFIS expert register in machine-readable form and printouts from the enlarged data base were presented to several international meetings for further verification. All information received through July 1977 has been included within the ASFIS data base which will be kept continually updated. A supplement containing omissions from the Directory and all errors notified to FAO or IOC will be published at an early date.

Copies of the directory have already been sent to all institutions listed therein and additional copies are available free of charge upon request from the Secretary IOC, Unesco, Place de Fontenoy 75700 Paris, France.

IOC Forms Working Group to Study Future Role and Function of Commission

The member states of the Intergovernmental Oceanographic Commission decided in April 1977 that the time was ripe to carry out a full and careful in-depth study of the future role and functions of the Commission, taking into account both the developments at the Third UNCLOS and the increased interest in the oceans and their potential which have been engendered by the Conference.

An ad hoc task team composed of member states of the Executive Council was formed under the previous Chairman of the Commission, Dr. G. F. Humphrey. This quickly confirmed the urgent need for a thorough study to ascertain the most appropriate intergovernmental structure that can be developed for the future in the field of marine scientific research and related activities to meet the needs of the international community, and how the Commission fits into this structure. At its recent tenth session, the IOC Assembly formed, by resolution X-25, a Working Group on the Future Role and Functions of the Commission under Dr. A. Ayala-Castañares(Mexico) as Chairman and Dr. N. J. Campbell (Canada) as Vice-Chairman.

Already four questionnaires on programmes, organization, interrelationships with ICSPRO and other UN Agencies, and work methods have been distributed to members of the working group for early completion. An analysis of responses will be studied by the working group which will hold its first session in FAO headquarters, Rome in June 1978.

Copies of the questionnaires have been sent out by the Chairman for information to all member states of the Commission, to the ICSPRO agencies (UN, FAO, Unesco, WMO and IMCO), to the advisory bodies of the Commission (SCOR, ACMRR and ECOR) and to the chairmen of the various subsidiary bodies of the Commission, with an invitation to provide comments and input

to the work of the Group. Further copies can be provided (in English, French, Spanish or Russian) to interested individuals bodies or groups, on request to the Secretary IOC, Unesco, Place de Fontenoy, 75700 Paris; all responses and comments received will be taken into account by the working group in their deliberations.

IOC Sponsorship of Marine Science in the Caribbean

We have just received the first issue of the *IOCARIBE Newsletter*. What is *IOCARIBE?* The following article, reprinted from the newsletter, answers the question.

Having recognized that marine science development could best be advanced and stimulated through cooperation, various nations interested in marine scientific research in the Caribbean - Gulf of Mexico region, established in 1968 the Cooperative Investigations of the Caribbean and Adjacent Regions (CICAR), sponsored and coordinated by the Intergovernmental Oceanographic Commission. Membership included many contiguous states of the region as well as several European nations having direct interest in the oceanography of the region and in its wider effects on ocean processes; CICAR began as a cooperative expedition with a concept similar to that of the International Indian Ocean Expedition (IIOE) but subsequently evolved its purposes to include the recognized need to emphasize and develop international mutual assistance among the member nations.

When the investigation was officially terminated at the end of 1975, the benefits gained by member states in the region from the close collaboration that had been developed under CICAR were fully recognized and a desire was expressed for a successor mechanism to be formed for this specific purpose, again under the sponsorhip of the IOC. The IOC Association for the Caribbean and Adjacent Regions (IOCARIBE) was therefore established by the IOC Assembly at its ninth session (October-November 1975) and held its first session in Caracas in July 1976.

Experience has thus shown that marine science and international activities in marine affairs may best be advanced through cooperation and mutual assistance. IOCARIBE hence goes beyond the expedition concept of the IIOE and early CICAR. The new Association also recognizes that in addition to scientific research, there are certain regional needs, such as the training and education of human resources, the interchange of ideas, information and people, the sharing of facilities and capabilities, and is seeking methods to meet them.

In consideration of the wide scope of IOCARIBE, the IOC decided to establish a Secretariat consisting of the elected IOCARIBE Chairman and two IOC staff members as full-time regional secretaries. The basic purpose of the IOCARIBE Secretariat is to initiate, promote and coordinate the recommendations of the Association, in cooperation with the Member States of IOCARIBE, the IOC and other United Nations agencies (and their regional subsidiary bodies). The Secretariat presently is hosted by the government of Trinidad and Tobago.

As stated in the Annex to IOC Resolution IX-13, "Membership shall consist of all Member States of the Commission in the region and other interested Member States." The membership to date is therefore:

FROM THE REGION: Colombia, Costa Rica, Cuba, Dominican Republic, France, Guatemala, Guyana, Haiti, Jamaica, Mexico, Netherlands, Nicaragua, Panama, Surinam, Trinidad and Tobago, United Kingdom, U.S.A., Venezuela.

FROM OUTSIDE THE REGION: Brazil, U.S.S.R.

INTERNATIONAL TSUNAMI INFORMATION CENTER

Tsunami Reports

The first issues of this new ITIC publication were published in May 1978 and dealt with all 20 potentially tsunamigenic events which occurred in 1977 and with the Philippine tsunami of August 1977. Further issues covering events for the period January - March 1978 are now being distributed.

Copies of "Tsunami Reports" are free upon request, but for reasons of cost, ITIC is not able to provide binders.

ITIC Programs and Activities

In response to a request received from the U.S. National Weather Service, ITIC recently prepared a report which outlines in detail its programs and activities. It is intended to publish a summary of the report in the next issue of the "Newsletter," but copies of the full report are available from ITIC upon request.

The report is also being used as a basis for an information pamphlet which is presently being prepared at ITIC.

Two Recent Articles about Tsunamis

ITIC is quite frequently asked to supply information and illustrations for use in articles written about tsunamis. Two such articles have recently appeared.

Tsunami: Surging Walls of Water - ROBERT NAKAMURA
In *Powers of Nature* - Special Publications Division, National Geographic Society, Washington D.C. 1978.

Taming the Killer Waves of the Pacific - LENNARD BICKEL
In *Reader's Digest* - The Reader's Digest Association Inc., Pleasantville, N.Y. 10570, April 1978.

Both articles are written in a "popular" style and appear in publications

which have a large circulation. Thus, they should greatly assist in the task of making the general public aware of tsunamis and their possible danger.

EDITORIALS AND LETTERS

Seismological Data from the People's Republic of China

Several items of seismological data from the People's Republic of China are available from the National Geophysical and Solar Terrestrial Data Center, Boulder, Colorado 80302, USA. These include reports given to members of the American Delegation of Seismologists who visited there in October 1974, data individually requested from the Academia Sinica by American scientists, reports sent regularly to the Center on an exchange basis by the Academia Sinica, and special research projects. These are available as described below.

(1) *Preliminary Seismological Report of the Central Station, Peking, and Auxiliary Stations* (1960-65 inclusive). Earthquake arrival times and epicenters recorded at as many as 13 stations in the People's Republic of China. Station locations and standard instrumental response characteristics are listed. About 950 pages. Available on 16-mm microfilm or microfiche from mimeograms of varying quality, but all legible. In English. Price $10.

(2) *Chinese Seismological Station Reports* (1971, 1972, and 1973), *Seismological Bulletin of Chinese Stations* (1974). Earthquake arrival times and epicenters recorded at as many as 17 stations in the People's Republic of China. Also a list of stations and plots of instrumental characteristics. About 250-400 pages in each bulletin. Available on 16-mm microfilm or microfiche. Some Chinese text. Price $10.

(3) *Monthly Earthquake Observation Report for Peking Station.* Lists phase arrival times and magnitudes. Issues from January 1975 to near-current are available in zerographic copies. About 4 pages each month. Price $0.30 per page.

(4) *Catalog of Chinese Earthquakes.* Published in 1970. In two parts -- part one covering 1177 B.C. to 1900 A.D. and part two covering 1901 A.D. to 1949 A.D. Dates, epicenters, magnitudes, intensities at various locations, descriptive material on damage and effects, and isoseismal sketches. Text in Chinese. 359 pages. Available on 16-mm microfilm or microfiche. Price $10. Title page, table of contents and preface translated. Full translation is under consideration by American Geophysical Union. Original document is on deposit at the Library of the East Asian Research Center, Harvard University.

(5) Punched cards containing data from the catalog cited above are available for $10 for each of the parts (part two has been augmented with new and revised data through 1976) or $15 for both parts. Complete descriptions of these expanded catalogs and the format for the punched cards are

contained in "A Catalog of Historical Earthquakes in China" by W.H.K. Lee, F.T. Wu, and Carl Jacobsen, *Bulletin of the Seismological Society of America,* vol. 66, no. 6, December 1976, pp. 2003-2016, and "A Catalog of Instrumentally Determined Earthquakes in China (Magnitude $\geq$6) Compiled from Various Sources" by W.H.K. Lee, F.T. Wu, and S.C. Wang, *Bulletin of the Seismological Society of America,* vol. 68, no. 2, April 1978.

(6) Copies of seismograms for stations in the People's Republic of China. Earthquakes of November 8 and 18, 1971. Twelve station days, three components each. Stations are Peking, Paotow, Lhasa, Nanking, Seh-shan, Wuchang, Urumchi, and Sian. All stations are not available for each earthquake. Detailed list on request. Available on 35-mm microfilm, but quality only fair. Price $5.50 for set.

Further information on these data may be obtained from Carl von Hake, NGSDC, telephone (303) 499-1000, extension 6472 FTS 323-6472. Orders may be sent to NOAA, Environmental Data Service, NGSDC - Code D62, Boulder, CO 80302, USA.

Checks should be made payable to "Commerce/NOAA/NGSDC." A minimum order of $10 is required unless special arrangements are made.

REPRINTS

Earthquake Predictions?

In March 1977 (Newsletter, Vol X, No. 1) we reprinted an article "Earthquake Prediction: Fact and Fallacy," by Roger N. Hunter, in which he described a program designed to check the validity of earthquake predictions. We now reprint another article which analyses the results of the program over an eighteen-month period.

The article originally appeared in the *Earthquake Information Bulletin, Vol 10, No. 3* (May-June 1978). This excellent publication of the United States Geological Survey can be obtained for $3.00 ($3.75 for foreign mailing) from the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

Prediction Monitoring and Evaluation Program: A Progress Report

By Roger N. Hunter and John S. Derr
U.S. Geological Survey, Denver, Colorado

Can your friend's relative really predict earthquakes? Or how about that fellow in the mountains who has always liked geology, does he have the answer to the "when" of earthquakes? And if these people do actually predict an earthquake, is it a lucky guess or are they tuned in to something? A lucky guess would be interesting; 1 correct guess in 100 tries is hardly prediction. But 90 out of 100 -- now that's prediction!

As part of an attempt to separate useful predictions from inaccurate guesses, we have kept score on earthquake predictions from all sources brought to our attention over the past year and a half. The program was outlined in "Earthquake Prediction: Fact and Fallacy" by Roger N. Hunter (Earthquake Information Bulletin, vol. 8, no. 5, September-October 1976,p. 24-25). The program attracted a great deal of public attention, and as a result, our files now contain over 2500 predictions from more than 230 different people.

We consider this a large enough sample for a statistical study and are no longer scoring predictions from the general public. Predictions, which we continue to receive, are now simply dated and filed. At present, 92 of these people have been scored and evaluated. Once all the 1977 earthquakes are available for scoring purposes, a final report will be published. After that, the program will be used only to evaluate scientific predictions.

The essential details of the predictions are put into a computer. Once the predicted time has passed, the list of earthquakes large enough to have been located is scanned for a possible match. Should the prediction prove to be correct, it receives a score based on the six bits of information which could have been given: year, month, day, time, size, and location.

The score is, then, the number of bits correctly given divided by six. It can range from 0.00 for a clear miss to 1.00 for a perfect hit, depending on the amount of information given and the degree of accuracy. In scoring the predictions, a reasonable amount of leeway is allowed on time, size, and location. For example, half credit is given for a "near miss" in location, generally within 600 kilometers of the edge of the area predicted. Likewise, credit is given for "time" if the hour is correct. Full credit is given for magnitude if it is within the range specified or within one unit of the specific predicted value.

The accuracy of the prediction, however, still does not tell us how valuable the prediction is. Obviously, it would be far easier to "predict" an earthquake in Alaska, where there is a good chance every day of one occurring, than in Florida, where earthquakes are very rare. Because of this difference, we calculate a value for the prediction based on the seismicity of an area. For example, a score of 1.0 on a magnitude 3 earthquake in Alaska would have a value of nearly 0, whereas the same score on a magnitude 3 earthquake in Florida would have the maximum value of 1.0.

Some modifications have been made to the program since 1976, notably in the statistical tests. The Kolmogorov-Smirnov test is now used to evaluate people who have only a limited number of predictions on file. It has proved very useful in providing an "early warning" of a predictor's performance, but it is only a preliminary test. The box and figure accompanying this article give an explanation of the Kolmogorov-Smirnov test. *(Box and figure not reprinted here)*

The chi-square test is still considered the best indicator of performance but requires a great deal of data, and very few people have enough predictions on file to permit a statistically valid chi-square calculation. The box and figure accompanying this article give an explanation of the chi-square test. *(Box and figure not reprinted here)*

People are divided into eight categories according to the method they use in making their predictions. The categories are as follows:

0...Method unknown to us (80 cases evaluated).
1...Professional Scientist (no cases evaluated).
2...Amateur Scientist (one who has no formal training in geoscience; 85 cases evaluated).
3...Sensitive (one who has physical sensations before a quake; 60 cases evaluated).
4...Psychic (158 cases evaluated).
5...Astrologer (240 cases evaluated).
6...Dreamer (5 cases evaluated).
7...Religious Visionary (1 case evaluated).

The predictions are judged by comparing them to a family of random "predictions" created by the computer's random number generator. Different sets of random predictions are generated, which resemble as closely as possible those of the predictors. These random predictions were scored and evaluated as though they were real ones. The results became the standards against which real predictions are judged. The Kolmogorov-Smirnov and chi-square tests use the random results as "expected" values. The program can evaluate either an individual, if there are enough predictions, or all the people as a whole that are in a single category.

If the predictions are not significant but were simply the result of guesses or incorrect theories, then we would expect the predictions to be as good as a coin toss; that is, random. The tests would then give low significance levels to these guesses. However, the results which we have obtained so far, are somewhat different from this. Category 1, Professional Scientist, has no scored predictions. Each of the remaining seven categories has different levels of significance, some better than chance and some worse. However, no category is significantly better than chance, where "significantly" means the 99-percent confidence level. This means that there is only 1 possibility in 100 that the prediction was chance alone.

Some of the categories, however, are significantly worse than chance, notably amateur scientists, astrologers, and psychics. This conclusion is based on both the Kolmogorov-Smirnov and chi-square tests at the 99-percent confidence level. We think the reason for this result is that the random predictions were specific, whereas the real predictions were often more vague, which caused scores to be lower. The results only apply to the categories of psychics and astrologers taken as a whole; perhaps an individual within the group will have valuable predictions. But this does mean that random predictions are significantly more accurate than those of the psychics and astrologers taken as entire groups!

On the individual level, the results are again unexpectedly low; most people's scores and values are lower than the random predictions. We might have expected a more even split, with half better than expected and half worse. The reason for the uneven distribution for individuals is apparently the same as for the categories: the real predictions were more vague than the random ones.

The statistical tests we used are based on probability theory. In a test such as Kolmogorov-Smirnov, a certain percentage of those tested should be better than expected at any level of interest, given a large enough sample. The results of our testing conform to that expectation. One of the 92 scored predictors has statistically significant predictions and exceeds a 0.01 test (probability)level. However, this unusual performance is to be expected in this kind of experiment. Therefore, having a significant value at that level does not necessarily constitute proof of any predictive ability. The proof of ability would lie in staying below the 0.01 probability level as more and more predictions are scored. The person who is below this level has only four scored predictions so far, and this is too few to be considered reliable.

Although it appears that we need more data for our statistical tests, the data we have analyzed lead us to believe that these predictions will not be of any value to the scientific community or the general public. As in the above mentioned case, the good score exhibited by one person is based on four predictions. Several others have done well on their first few trials but successive predictions drop their performance down to insignificance.

TSUNAMI WARNING SYSTEM IN THE PACIFIC

Current List of National Contacts: International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU)

CANADA	Chairman ICG for ITSU Mr. G.C. Dohler Canadian Hydrographic Service Department of the Environment 615 Booth Street Ottawa K1A OH3	National Contact Mr. Sydney O. Wigen Ocean & Aquatic Sciences Pacific Region Institute of Ocean Sciences Patricia Bay,P.O.Box 6000 9860 W. Saanich Road Sidney,B.C. V8L 4B2
CHILE	Sr. Ricardo E. Montaner Jefe de la Sección Mareas Y Corrientes de este Instituto Hidrografico de la Armada Casilla 324 Valparaiso	
CHINA	Nomination not received (IOC contact: Permanent Delegation of China to Unesco)	
ECUADOR	Capitán de Corbeta Pedro R. Cabezas Director, Instituto Oceanografico de la Armada Casilla #5940 Guayaquil	
FIJI	Mr. Ronald N. Richmond Director of Mineral Development, Mineral Resources Division Private Mail Bag,G.P.O.,Suva,Fiji Islands (CABLE:GEOLOGY SUVA)	

FRANCE

M. Jacques Recy
Directeur de Recherche
Office de la Recherche Scientifique et Technique Qutre-Mer
B.P. 4
Nouméa Cédex (Nouvelle Calédonie)

GUATEMALA

Ing. Jose Vaussaux Palomo
Jefe del Departamento de Sismologia
Division del Observatorio Meteorologico Nacional
Ministerio de Agricultura
Palacio Nacional
Guatemala

INDONESIA

Dr. Aprilani Soegiarto
Director
Lembaga Oceanologi Nasional (LON)
of the Indonesian Institute of Sciences
P.O. Box 580 Dak
Jakarta Utara

JAPAN

Dr. Hideo Watanabe
Head, Seismological Division
Observation Department
Japan Meteorological Agency
1-3-4, Ote-machi
Chiyoda-ku
Tokyo (CABLE: MEOROAGENCY TOKYO)

KOREA

Mr. Myong Bok An
Director of Weather Analysis
Central Office of Meteorology
1, Songweal-dong, Chongro-ku
Seoul 110

NEW ZEALAND

Dr. R.A. Heath
New Zealand Oceanographic Institute
P.O. Box 12-346
Wellington North

PERU

Teniente César Vargas Faucheux (Vice-Chairman, ICG for
Jefe, Departamento Oceanografía ITSU)
Dirección de Hidrografía y Navegación de la Marina
Saenz Peña No. 590
La Punta, Callao

Capitán de Corbeta Sevilla Aspillaga
Casilla Postal 80
Dirección de Hidrografía y Navegación de la Marina
La Punta
Callao

PHILIPPINES
Mr. Wellington A. Miñoza
Chief, National Geophysical and Astronomical Service
PAGASA
1424 Quezon Boulevard Extension
Quezon City

SINGAPORE
Mr. K. Rajendram
Director, Meteorological Service
Meteorological Office
3rd Floor, 15 Grange Road
Singapore 9 (Republic of Singapore)

THAILAND
Commander Thanom Charoenlaph
Hydrographic Department
Royal Thai Navy, Aroon Amarin Road
Bangkok 6

USA
Mr. Bertrand J. Thompson
Chief, Oceanographic Services Branch
National Oceanic and Atmospheric Administration
National Weather Service (W.G.)
Silver Spring, Md. 20910

USSR
Dr. V.M. Popov
Chief of the Arctic, Antarctic and Marine Department
Pavlik Morozov 12
Moscow

NATIONAL AND AREA REPORTS

(The following article briefly describes the history and operation of the Alaska Regional Tsunami Warning System)

The Alaska Regional Tsunami Warning System

The establishment of seismological observatories in southcentral Alaska and in other areas of United States's largest and most seismic active state was a major goal of the Coast and Geodetic Survey for many years. As the result of the great earthquake which occurred in the Prince William Sound area of Alaska in March 1964, State and Federal officials were alerted to the real need for such facilities, not only from the standpoint of seismic investigations but also to serve as a tsunami warning system for Alaska and the northern Pacific.

Funds were provided by U.S. Congress in 1965 to construct two new observatories and establish a tsunami warning system in Alaska. The city of Palmer, located forty-two miles northeast of Anchorage in the heart of the lush farmlands of the Matanuska Valley, was selected as the site for the primary observatory. With the dedication of the Palmer Seismological Observatory on September 2, 1967, the Alaska Tsunami Warning System became operational.

The Observatory, now under the U.S. National Weather Service, is headquarters for the Alaska Tsunami Warning System and has a staff of four

geophysicists and two electronics technicians. Although the Observatory is manned only 44 hours per week, two staff members are in standby duty status at all times. An alarm system is used to alert standby personnel in their homes as night, that a major earthquake has occurred. All staff members are required to live within five minutes driving time of the Observatory and the office consistently disseminates earthquake epicenter and tsunami information within fifteen minutes of the initial alarm.

The primary function of the Alaskan Tsunami Warning Center (ATWC) is detecting and locating major earthquakes in the northern Pacific region and determining if the size and location is sufficient to generate a tsunami. If warranted, immediate tsunami information and warnings are issued to the coastal population of Alaska, Washington, Oregon, California and Canada in order to minimize property damage and loss of life. Vital immediate earthquake information is furnished to the National Earthquake Information Center in Boulder, Colorado, the Pacific Tsunami Warning Center in Honolulu, and the Japan Meteorological Agency in Tokyo.

The Alaska Regional Tsunami Warning System basically consists of the Obs at Adak and Palmer, 18 remote seismic stations, and 8 tide gage stations; seismic and tide data are telemetered in real time from each of these stations to the Warning Center.

In addition to carrying out its primary functions, the ATWC provides the following services:

1. Provides earthquake epicenter, magnitude, information, and advice on earthquakes, routinely to the public, private industry, government agencies, state agencies, and news media.

2. Supplies essential information for safeguarding maritime commerce, for aiding engineering projects, protection of coastal property as well as for various scientific, recreational and defense purposes from rapid readout of tide data at Palmer.

3. In cooperation with the Geological Survey, operates and maintains an extensive network of strong motion accelerographs and seismoscopes located in active seismic areas of Alaska to provide ground motion and building response characteristics resulting from close-by strong earthquakes.

4. Carries on research and study programs to improve the precision and lower the response time of the warning system.

5. Conducts development, testing, and installation of seismic, communication, tidal, and tsunami instrumental systems and develops ways to improve accuracy and reliability of the various systems.

6. Conducts a Cooperative Seismic Recording Program with the U.S. Geological Survey involving the operation and recording of over 50 seismic stations in Southern and Southeastern Alaska. Data from these stations are used in intensive investigations of seismic activity

7. Maintains a catalog of basic raw seismic data, seismograms, and tsunami records as a source of readily available data for the scientific and engineering community.

8. Informs the general public of basic seismology, environmental hazards due to earthquakes and tsunamis, and the products and functions of the National Oceanic and Atmospheric Administration.

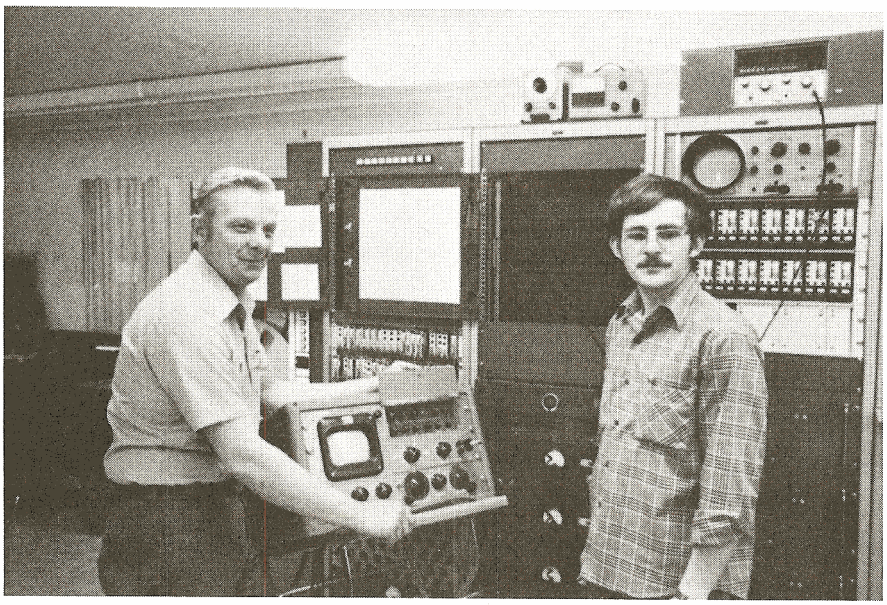
9. Operates, maintains, installs, and repairs the multi-component seismograph and tide gage systems and connecting equipment.

10. Provides logistic and technical support for all seismic, tide, and tsunami systems in Alaska.

Headquarters for the Alaska Tsunami Warning System at Palmer

Bob Eppley, Chief ATWC, with State Warning Phone

George Carte, Geophysicist, at 32 inch globe



Electronic technicians: L to R - Wayne Jorgensen and Alec Medbury

John Sindorf, Geophysicist, examining records

ANNOUNCEMENTS

16th International Conference on Coastal Engineering: August 27 - September 3, 1978 at Congress Center, Hamburg, Federal Republic of Germany

This Conference is being sponsored by the American Society of Civil Engineers and the German Society of Harbour Engineers.

Subjects of the Conference are:

Wave Research
Coastal Sediment Problems
Storm Surge Research
Coastal Structures and Related Problems
Coastal and Estuarine Problems (ecology, pollution, etc.)

Enquires should be addressed to:

Dr.-Ing. Naumann
Chairman, Organizing Committee
ICCE'78
Hafenbautechnishe Gesellschaff
Dalmannstr 1
2000 Hamburg 11
Germany (F.R.)

NOTE - From August 24-26, 1978 a Symposium on "Mathematical Modelling of Estuarine Physics" will be held in Hamburg. This Symposium is not part of the Conference. Further information can be requested from:

J. Sündermann
Technische Universität Hannover
Lehrstuhl für Strömungsmechanik
Welfengarten 1, D-3000 Hannover

International Hydrographic Technical Conference; May 14-18, 1979; Government Conference Centre, Ottawa, Canada

The Canadian Hydrographic Service, under the auspices of the Government of Canada and in conjunction with the Fédération Internationale des Géomètres and the Canadian Institute of Surveying is hosting the above conference. The theme is "Development of Ocean Resources" and the following topics will be featured:

Sea Bottom Mapping
Location and Emplacement Techniques
Juridictional Consideration
Education and Training

For further information write:

Organizing Committee
Technical Conference on Hydrography
Room 209, 615 Booth Street
Ottawa, Ontario, Canada K1A OH3

Coastal Structures 79 - Specialty Conference on the Design, Construction, Maintenance and Performance of Port and Coastal Structures - Rosslyn, Virginia - Washington, D.C., 14-16 March 1979

Sponsors:

Research Committee - Waterway, Port
Coastal and Ocean Engineering Division, ASCE
Hydraulic Structures Committee - Hydraulics Division, ASCE
National Capitol Section, ASCE
U.S. Army Coastal Engineering Research Center
U.S. Naval Facilities Engineering Command

For information write:

Dr. Robert M. Sorensen
Chairman, Program Committee
Coastal Structures 79
c/o Coastal Engineering Research Center
Kingman Building
Fort Belvoir, Virginia 22060

International Symposium on Wave and Tidal Energy; September 27-29, 1978; Canterbury

For information write:

BHRA Fluid Engineering Organizing Secretary
Wave & Tidal Energy Conference
Canfield
Bedford MK430AJ
England

14th Pacific Science Congress, 20 August - 5 September 1979, Khabarovsk, USSR

Founded in 1929, the Pacific Science Association holds Pacific Science Congresses every four years and, since 1969, Inter-Congresses which meet during the intersessional period. The 14th Congress will cover 12 themes for which papers are now being solicited. Persons wishing to receive further information should contact the Organizing Committee of the 14th Pacific Science Congress, 44 Vavilov St., V-333 Moscow, 117333 USSR.

The PSA has recently broadened its membership regulations to enable individual scientists to participate in its work. Annual dues for member scientists are set at $15 and may be sent to the Pacific Science Association, P.O. Box 17801, Honolulu, Hawaii 96817, USA.

Second International Conference on Microzonation for Safer Construction Research and Application, November 26-29, 1978, San Francisco, California

The conference is sponsored by the National Science Foundation, UNESCO, American Society of Civil Engineers, Earthquake Engineering Research Institute, Seismological Society of America and the Universities Council for Earthquake Engineering Research.

The conference will bring together persons from such diverse backgrounds as geophysics, geology, seismology, engineering, economics, sociology, architecture, urban planning, government administration and insurance. Knowledge concerning earthquake microzonation techniques will be summarized and future research needs identified. Comprehensive proceedings will be published to serve as a reference document for those faced with the responsibility of incorporating relevant ground and site characteristics into planning and location of communities and design of safe structures in seismically active regions. Contact: M.A. Sherif, Conference Chairman, 132 More Hall, FX-10, University of Washington, Seattle, WA 98195, (206) 543-6777.

The 1st International Conference in Israel on Mass Casualty Management, Safad, Israel, September 17-20, 1978

How can a country or region prepare for the complex organizational, medical, sociological and ecological problems posed by disasters? Papers are called for. Deadline for submission of abstracts is: April 15, 1978. The Secretariat, P.O.B. 16271, Tel Aviv, Israel.

UN Conference on Science and Technology for Development, Austria 1979
First Regional Preparatory Meeting, Bangkok, 8-12 December 1978

UN ESCAP (UN Economic and Social Commission for Asia and the Pacific) called a regional preparatory meeting at its headquarters in Bangkok for the UN Conference on Science and Technology for Development in order to assess the progress made in the preparation of national papers and to make recommendations on a maximum of five subject areas in science and technology for the ESCAP region. These recommendations were to be considered by the Preparatory Committee for the Conference at its Fourth Session in January--February 1978.

The five subject areas recommended by the ESCAP region are: Food and agriculture; Natural resources; Energy; Health and nutrition; and Industrialization.

ABSTRACTS AND RESUMES

Information Sources for Natural Hazards Research - Organizations, Periodicals, Newsletters and Reference Sources

Kathleen Torres and Penny Waterstone
Natural Hazards Research and Applications Information Center
University of Colorado
Boulder, Colorado 80309

This publication lists possible information sources on natural hazards. Part I is a list of organizations which have hazard related publications available for public distribution. This list identifies serial publications and publications lists when available. Part II is a periodical and newsletter index, organized by title, and includes a short annotation and ordering information for each item. Part III is an annotated list of indexes and/or reference sources that are particularly useful for natural hazards research.

The authors would appreciate receiving any publications or information which could be used to update and expand this compilation of information sources.

Survey of Practice in Determining Magnitudes of Near Earthquakes - Part 1: North, Central and South America

W.H.K. Lee
U.S. Geological Survey
Menlo Park, California 94025
and
R.J. Wetmiller
Division of Seismology
Ottawa, Ontario, Canada K1A OY3

Report SE-9. World Data Center A for Solid Earth Geophysics
January 1978

This report is part of a plan to make data-related information conveniently available to the scientific community; in this case the practices used by various groups in determining the magnitudes for near earthquakes are presented. This information was compiled under the auspices of the IUGG/IASPEI (International Union of Geodesy and Geophysics/ International Association of Seismology and Physics of the Earth's Interior) Commission on Practice and is being reprinted by WDC-A for Solid Earth Geophysics as one of its data services.

The work is appearing in two parts: Part 1 (the present report) covers North, Central, and South America; Part 2 (Report SE-8*) treats Europe, Asia, Africa, Australasia, and the Pacific.

Reevaluation of Modified Mercalli Intensity Scale for Earthquakes Using Distance as Determinant

Rutlage J. Brazee
National Geophysical & Solar-Terrestrial Data Center
Boulder, Colorado

NOAA Technical Memorandum EDS NGSDC-4, January 1978.

An assumption is made that the attenuation of earthquake intensity parallels, or is representative of, the dissipation of earthquake energy and thus varies smoothly with distance outward from the center. A model embodying this concept is developed based on 400,000 earthquake intensity elements collected by the U.S. Coast and Geodetic Survey and its successor agencies during the period from 1928-74. Curves for each intensity element of the Modified Mercalli Intensity Scale of 1931 are then derived and fitted to the model. A revised intensity scale is assembled by reassigning the intensity elements in accordance with the results of the fitting process.

Edge Waves on the New Zealand East Coast

R.A. Heath
New Zealand Oceanographic Institute
Wellington, New Zealand

Marine Geodesy (In Press)

Tide gauge records from several New Zealand east coast ports show persistent oscillations in sea level with a period of 2.4-2.7 h. These are superimposed on local resonant oscillations and appear to be associated with edge wave excitation on the continental shelf, possibly by meteorological disturbances. A shelf response is also excited by tsunamis.

Mindanao, Philippines, Earthquake Report, 1978
119 p. $10.00 (United States); $11.00 (foreign).

Published by and available from:

Earthquake Engineering Research Institute
2620 Telegraph Avenue
Berkeley, CA 94704

A reconnaissance team from the Earthquake Engineering Research Institute, under the leadership of J.L. Stratta, arrived on the scene of the southern Philippines earthquake of August 17, 1976, within a few days. The team, including T.J. Canon, C.M. Duke, and L.G. Selna, has published the results of their survey. Their report contains chapters on soils, lifelines, tsunami, building and bridge damage, and a summary of their observations. The report also has social science observations by J.E. Haas and a discussion of Mindanao seismicity by D.J. Leeds.

"The Delivery of Emergency Medical Services in Disasters"
Editor: Verta A. Taylor. Mass Emergencies (Special Issue)(1977) 3:135-204

Elsevier Scientific Publishing Company
P.O. Box 211
Amsterdam, Netherlands

This special issue is devoted to a discussion of problems faced by emergency medical services (EMS) in both natural and technological disasters. Practical problems confronting EMS planners and operational personnel are discussed, as well as the need to apply rigorous research methods and systematic theoretical analyses to problems of EMS delivery. Other topics include: overlapping jurisdictions; impact of federal EMS legislation; the need for, and existing lack of, adequate needs assessment studies.

Local Tsunamis and Possible Local Tsunamis in Hawaii

Doak C. Cox
Environmental Center
and
Joseph Morgan
Department of Geography
Hawaii Institute of Geophysics
University of Hawaii
Honolulu, Hawaii

Published November 1977, Environ. Ctr. Cn: 0014, HIG-77-14

A list of reported tsunami events in Hawaii has been compiled from catalogs of tsunamis, other geophysical literature, and local contemporary sources. Of the events listed, 48 had been reported as tsunamis of local or uncertain origin. Intensive search of contemporary sources of information indicated that no unusual waves were actually observed on Hawaiian coasts on the dates of 17 of the reported events, and that the unusual waves of six of the dates were certainly of meteorological origin and on one of the dates were certainly a distant tsunami. There may have been two local tsunamis on each of two dates, however.

Reliable evidence could be found for only 21 possible local tsunamis, including two on one of the dates and two on another. Local tsunami generation is certain for six, probable for two, questionable for five, and very doubtful for eight.

Runup heights of possible tsunamis have been compiled for all coastal sites at which there were reports of measurements or of effects from which the heights might be estimated. The highest runups were reported for the certain local tsunamis of 2 April 1868 and 29 November 1975. Considerable coastal subsidence accompanied the generation of both tsunamis; their maximum runup heights would have exceeded 50 feet if measured from pre-subsidence sea level.

Twelve of the possible local tsunamis were associated with earthquakes, including those of April 1868 and November 1975 that were associated with the two largest earthquakes in Hawaiian history. Those two and three other certain tsunamis were probably generated by tectonic displacements of the submarine slopes. There may have been a second independently generated tsunami of tectonic origin associated with the 1868 earthquake. The significance of the earthquake associations of the rest is doubtful, with one exception (a possible tsunami generated by a landslide triggered by an earthquake).

Eight of the possible local tsunamis were associated with volcanic activity. However, direct connection is probable in the case of only one tsunami observed on shore; that one was associated with a lava flow entering the ocean and may have resulted from submarine slumping of the lava.

Tectonic disturbances or submarine landsliding were possible sources of the local tsunamis whose generating mechanisms are uncertain.

Six of the possible local tsunamis were generated along the southeast coast of Hawaii. These include three of the certain local tsunamis, among them the major tsunamis of 1868 and 1975. Along the west coast of Hawaii, one local tsunami was certainly generated and three others possibly so; along the northeast coast of Hawaii,possibly three; along the north coasts of Maui, Molokai, or Oahu, possibly four; and along the coast of Lanai or the south coasts of Maui, Molokai, or Oahu, possibly three.

Height-frequency distributions indicate that a local tsunami with a maximum runup height of about 40 feet may be expected, on the average, every hundred years, the likelihood being greatest on the northeast coast of Hawaii.

Packaged Literature Search 78-4: Tsunamis, First Edition
May 1978
Robert R. Walter
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Environmental Data Service
Washington D.C.

This packaged literature search was generated completely by computerized retrieval. It contains citations from the Oceanic Abstracts data base for the period 1964 through about December, 1977. Citations are arranged by descending citation number. This generally means that citations to the most recently published articles are listed first.

Abstracts for each article are available in the publication OCEANIC ABSTRACTS, which is published by Pollution Abstracts, Inc., 620 S. Fifth St., Louisville, KY 40202. Abstracts are included in this packaged search only for the year 1967, since at this time the computer-searchable file does not contain abstracts for other years.

Questions or comments regarding this packaged literature search should be referred to User Services Branch, D822, Library and Information Services Division, National Oceanic and Atmospheric Administration, NOAA, Rickville, MD 20852, Telephone 301-443-8330.

Customized literature searches are available on request.

Seismic Summary (March 24 to Press Time)

Event No.	Event	Location	Action Taken
1978-9	Mar 24 1947 (UT)	Kuril Is. 43.9 N	
(PTWC)	7.3	148.9 E	
(JMA)	7.3		
1978-10	Jun 12 0814	NE Honshu Is.,Japan 38.5 N	Queried tidal stations. Small tsunamis recorded
(PTWC)	7.7	141.7 E	at Senda (13 cm) and Hachinohe (8 cm). Negative reports from Kushiro-Shimizu, Chichijima
1978-11	Jun 14 1232 (UT)	Panay, Philippines 8.8 N	Press Release
(PTWC)	6.6	122.4 E	
1978-12	Jun 17 1511	Samoa/Tonga 15.9 S	Press Release
	7.4	172.2 W	
1978-13	Jul 23 1442 (UT)	North of Luzon, Philippines 22.0 N	Queried Okinawa - Negative
(PTWC)	7.0	121.0 E	

(PTWC) - Pacific Tsunami Warning Center, Honolulu

(JMA) - Japan Meteorological Agency, Tokyo